PATENT SPECIFICATION

582,605

Convention Date (United States of America): Aug. 30, 1943.

Application Date (in United Kingdom): July 14, 1944. No. 13514/44.

Complete Specification Accepted: Nov. 21, 1946.

COMPLETE SPECIFICATION

Improvements in Spray Guns

I, ALEXANDER FREDERICK JENKINS, a Citizen of the United States, of 1416—1428, W. Baltimore Street, Baltimore, 23, Maryland, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to spraying devices and has for its general object the provision of improvements in the nozzles of such devices whereby better atomization and distribution of the liquid material employed may be attained.

In a spray gun of the type now generally employed for applying paint, enamel or other liquid coating material to surfaces for the purposes of protection, ornamentation, or the like, the liquid material is aspirated through a valve controlled orifice disposed centrally of the forward face of the nozzle of the gun, by means of an annular jet of air under pressure; and if a relatively flat or fan-shaped spray is required, convergent supplemental jets of compressed air are directed through laterally disposed orifices in the nozzle so as to impinge upon the central jet of aspirated liquid and convert this substantially cylindrical or conical jet into one having an oval or even an approximately rectangular cross-sectional configuration.

Heretofore, or rather until the conception of my invention covered by Patent No. 482,922, the spray modifying jets have been in the form of solid cones emitted from fine circular orifices formed very accurately in the side portion of the nozzle so that the jets will impinge exactly upon opposite sides of the axis of the liquid jet. The liquid coating material is frequently also supplied to the gun under some degree of pressure and valves for regulating the pressures and quantities of the liquid and of both the aspirating and spray modifying air supplies are generally provided on the guns. The degree of atomization required, the nature and viscosity of the liquid to be sprayed, and the desired shape of the spray,—all of these factors determine the degree of adjustment necessary for these regulating devices; and in most cases the relative pressures are quite critical and must be very accurately controlled.

In the use of spray guns of the usual type in which solid supplemental jets of spray modifying air are employed, there is a tendency to cause a " split " in the spray, that is, a narrowing of the cross-section of the center of the spray and a lessening of the density of the spray at this point and an increase in density at the end portions thereof due to the unequal atomization of the sprayed liquid. To correct this condition, the usual practice, in constructions which permit it, is to reduce the supply of air to the supplemental jets. This adjustment, however, reduces the width of the spray and is apt to alter the character of the spray in other ways, especially when made in connection with the use of highly viscous and difficultly atomizable materials such as synthetic enamels and the like.

In my said Patent Specification No. 482,922, I have described a spray gun in which tubular or hollow conical spray modifying jets of air are provided, either alone or in conjunction with solid jets. By this means, a better atomization and distribution of the liquid material may be attained and the splitting eliminated, while at the same time there may be employed higher pressures or greater volumes of modifying air.

The present invention provides a modification of the nozzle disclosed in my aforesaid Patent Specification, by means of which an even better atomization and distribution of the sprayed material may be attained.

A spraying device of the class described, in accordance with the invention, comprises in combination means disposed centrally thereof for discharging a liquid spray, a means disposed at one side of said first-named means for discharging a tubular jet of air against said spray to modify its cross-sectional configuration, said second-named means being so constructed and arranged that one diameter of said tubular jet is longer than the diameter at right angles thereto.

[*Price* 1/-]

The manner of carrying the invention into effect is hereinafter described with reference to the accompanying drawings, in which:—

Figure 1 is a vertical longitudinal sectional view through the forward body portion and nozzle of a spray gun embodying the principles of my invention;

Figure 2 is a view in front elevation of the nozzle head of the spray gun;

Figure 3 is a fragmentary elevational view of the outer face of one of the wings of the nozzle as seen on line 3—3 of Figure 1;

Figure 4 is an end view of a pin or plug employed to form the annular jet orifice;

Figure 5 is a view in side elevation of the plug;

Figure 6 is a fragmentary view of the inner or forward face of one of the side wings of the nozzle showing one form of annular oval orifice;

Figures 7, 8, 9 and 10 are similar views showing modifications in which the widths of the orifice are varied at either the sides or ends thereof by either widening the opening in the nozzle or by narrowing the corresponding dimensions of the inserted pin;

Figure 11 is a similar view showing the substantially oval orifice flattened on four sides to the shape of a lozenge;

Figures 12 and 13 are views in side and end elevation respectively of a tool for placing or centering the inserts or pins in position while they are being secured to the nozzles;

Figures 14 and 15 are similar views of a tool for adjusting the inserts in directions along the long axis of the orifice; and

Figures 16 and 17 are similar views of a tool for making adjustments along the short axis.

Referring more particularly to Figure 1 of the drawings the numeral 10 designates the forward body portion of the spray gun which may be of any desired construction so far as the actuating and controlling mechanism is concerned. For example, it may follow, except as indicated otherwise herein, the construction of the spray gun illustrated in my U.S. Patent No. 2,269,057, dated January 6, 1942.

The body portion of the spray gun is provided with a liquid chamber or passageway 11 and a main air passageway 11a. The air passageway is divided adjacent the valve seat 13 to provide a forwardly directed passageway 14 leading to the supplemental flattening jets of the air cap and the diverging passageway 15 leading to the central aspirating air orifices. A reciprocating valve member 12 cooperates with the valve seat 13 to control the passage of air through the passage 14. The forward face 16 of the body portion of the gun is ordinarily formed in a single plane, although within the scope of the invention the construction of the body portion of the gun may vary widely.

The inner liquid nozzle portion is indicated generally by the reference numeral 20 and comprises the central rearwardly projecting nipple which is threaded as at 21 into the recess 11 formed in the forward portion 10 of the main body of the gun. The central portion of the liquid nozzle 20 is provided with a flange 22, the periphery of which may be squared for the application of a wrench or other suitable tool for removing and applying this portion of the nozzle to the spray gun. The forward end of the liquid nozzle proper is of a general conical configuration as indicated at 25 and is provided centrally at the tip thereof with a liquid orifice 26, the flow of liquid through this orifice being controlled by means of the needle valve 27 which projects rearwardly and is operatively connected with the trigger of the gun which is not shown therein, but may be of any usual or conventional construction or may be arranged as shown in my Patent Specification No. 482,020. The intermediate flange 22 is provided with an annular series of passageways 30 which constitute a portion of the communicating means between the air passageway 15 in the body of the gun and the forward air chamber 32 formed between the conical tip 25 of the liquid nozzle and the walls of the central air cap 35.

This air cap 35 is provided with the annular rearwardly extending flange 36 which fits around the annular flange 34 which extends forwardly from the portion 22 of the liquid nozzle. The flange 36 extends rearwardly to abut the intermediate flange 22 of the liquid nozzle and is provided with a radially outwardly directed flange 130 which is spaced from the flange 22 so as to leave an annular space 131 into which a screw-driver or other suitable tool may be inserted in order to remove the cap or tip 35 from the liquid nozzle. The flange 130 also provides an abutment element for the surrounding inner portion of the annular auxiliary jet air cap 42. Preferably the annular flange 34 of the liquid nozzle 20 is shaped as shown in Figure 1 and terminates short of the converging front walls of the cap 35 so as to provide as much of an enlargement within the air chamber 32 as possible.

The tip 35 converges forwardly to the plane of the face of the liquid nozzle and the inner margin of the opening therein

is spaced from the liquid nozzle tip 25 at a predetermined distance to provide the annular aspirating air orifice 40.

The outer annular air cap of this type of nozzle assembly is indicated generally by the reference numeral 42 and is provided with a central annular surface 37 which fits around the flange 36 of the supplemental air tip 35. The air cap is provided rearwardly with an outwardly extending annular flange 43 which forms a shoulder about which the inwardly directed flange 44 of the clamping ring 45 may engage. The clamping ring 45 is threaded to the outer periphery of an intervening annular thread carrying element 110 which is disposed between the flange 22 of the liquid nozzle and the forward face of the body of the gun. The inner annular surface 111 of the insert 110 fits around the central projecting portion 112 of the front end of the gun and is sealed against the rearward stepped face 113 of the body portion 10 as by means of the gaskets 115.

An inwardly disposed ring or washer 116 is held by the flange 117 of the member 110 so as to baffle and equalise the distribution of the central air supply passing through the passageway 15 before it enters the passageways 30. The annular intermediate member 110 is also provided with the annular recess or forward annular chamber 120 which is placed in communication with the air supply passing through the passageway 14 in the body of the gun by means of the series of holes 121. An inwardly projecting flanged baffle ring 122 and an outwardly projecting ring 123 are fitted within the chamber 120 in order to equalise the distribution of the auxiliary jet air supply upon opposite sides of the air cap.

The intermediate annular member 110 is provided around its outer periphery with the screw threads 125 upon which may be screwed the clamping ring 45 which is provided with the flange or shoulder 44 surrounding the shoulder 43 of the air cap.

At diametrically opposite points on the annular outer air cap 42 there are provided the forwardly directed outwardly divergent projections 50. These projections are of a substantially circular or cylindrical configuration and, as best shown in Figures 1 and 3, they are provided with reanwardly disposed substantially cylindrical recesses 52. The inner or forward faces of the projections are provided with oval or elliptical openings 53 which provide communication through these faces with the rear recesses or chambers 52. The chambers 52 are placed in communication with the baffled air chambers 120 in the rearward portion of the nozzle of the gun by means of the parallel spaced ducts 54, the rear ends of which open into the annular space 130 in the rear portion of the cap 42.

In order to close the rear end of the chamber 52 of the wings 50 of the nozzle cap, and also to shape the annular orifice in the forward faces of these wings there are provided the inserts or plugs 55. Each of these plugs is formed with the outer headed portion 56, a circular shoulder part 57 which fits snugly into the rear end of the recess or chamber 52, and the forwardly and inwardly projecting pin portion 58 which is of an oval or elliptical cross-section corresponding generally to the elliptical configuration of the opening 53 in the wing projections 50. The plugs 55 are inserted from the rear or outer side of the wings 50 so that the parts 57 fit the chamber openings and the pins 58 are centered symmetrically with the openings 53. This centering must be very accurately done, and special tools for accomplishing this purpose will be described. When properly applied and centered, the plugs are soldered firmly in place.

This arrangement results in the provision of a closed circular annular chamber into which the twin passageways 54 discharge air under pressure, and this air is then discharged through the oval or elliptical orifices 60 provided in the faces of the wings. One of the resulting oval orifices 60 is very clearly shown in Figure 6 of the drawings. It will be noted that in the preferred embodiments the long axis of the elliptical orifice is disposed transversely of the nozzle, while the short axis lies in the same plane as the central axis of the spray gun. This arrangement has been found to provide an exceptionally satisfactory spray modifying jet which produces a uniform wide pattern which does not vary sharply with changes in air or coating fluid pressure. However, for some purposes it may be desired to arrange the long axis of the elliptical orifice in the plane of the axis of the gun instead of the short one, and this variation also comes within the scope of the present conception.

In Figure 7, a modification of the uniformly wide annular spray jet orifice shown in Figure 6, is illustrated. In this arrangement the long diameter D_o of the opening 53 of the nozzle is maintained at substantially the same dimension as shown in Figure 6 but the long diameter D_p of the pin 58a is shortened, whereby there is provided oppositely disposed thickened portions 61 at the ends of the orifice. This will afford somewhat more

air at the ends of the spray pattern for certain conditions of operation. In Figure 8 the same effect has been attained by employing a pin 58 which is maintained at its original diameter shown in Figure 6, but the opening 53a has been lengthened as indicated at D'_0.

In Figure 9 of the drawings, the longer dimensions of both the pin 58b and the opening 53 have been maintained the same as in Figure 6, but the smaller diameter of the pin 58b has been narrowed as at d_p, this providing widened portions 62 upon each side of the orifice.

A similar effect is attained as shown in Figure 10 of the drawings by maintaining the dimensions of the pin 58 in both directions and by widening the opening 53b to the diameter d_0 thus providing the widened portions on the longer sides of the orifice.

In Figure 11 of the drawings, a substantially lozenge or rhombus-shaped annular orifice 65 is provided by forming the nozzle opening 53c and the pin 58c with corresponding cross-sections. This configuration may be employed where it is not so important to have the spray pattern very wide at the ends.

In Figures 12 and 13 there is illustrated a tool 70 for use in positioning or centering the elliptical pins 58 which cooperate with the side jet openings 53. The tool 70 is formed with a conveniently shaped shank 71 and a hollow or tubular portion 72 of the exact shape of the orifice 60. After the plug 55 is inserted into the chamber 52 and is roughly centered by means of the shoulder portion 57 the end 72 of the tool 70 is inserted from the forward or inner side of the wing into the orifice 60 thus accurately centering the pin 58 within the opening 53. Then the plug 55 is soldered firmly in place and finally the tool 70 is withdrawn.

In the event that after application to the device a pin 58 is found not to be properly centered, or if it becomes displaced through use, it may be recentered without dismantling the nozzle cap. In Figures 14 and 15 an adjusting tool 75 is shown which has an operating end 76 in the form of a half-oval, shaped to fit within one of the longer halves of an orifice 60. This tool is employed in cases where the pin 58 approaches the wall of the opening 53 too closely at a point adjacent the ends of the longer diameter. By inserting the end 76 of the tool 75 and carefully exerting a gradual sidewise pressure, the pin 58 may be strained toward its properly centered position. On the other hand, if the pin 58 is warped too closely to the wall of the opening 53 adjacent the end of a short diameter, the tool 80 may be used, the end 81 being shaped to occupy a long half-oval portion of the orifice 60.

It is understood that the construction and arrangement of the central aspirating jet of the gun may be varied widely and still derive the substantial benefits and advantages of my novel oval modifying jets. The central jets may correspond to those in my aforesaid patents or may follow the design of any known or anticipated aspirating jet arrangement.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In a spraying device of the class described, a nozzle comprising, in combination, means disposed centrally thereof for discharging a liquid spray, and means disposed at one side of said first named means for discharging a tubular jet of air against said spray to modify its cross-sectional configuration, said second named means being so constructed and arranged that one diameter of said tubular jet is longer than the diameter at right angles thereto.

2. A spraying device as claimed in Claim 1, wherein the tubular jet is substantially oval in cross-section.

3. A spraying device as claimed in Claim 1, comprising at each side of the liquid discharge means an annular air discharge orifice disposed so as to direct an air jet to impinge upon the side of the liquid spray at a point spaced from the nozzle.

4. A spraying device as claimed in Claim 3, wherein the air discharge orifices are of elliptical cross-section.

5. A spraying device as claimed in Claim 3, wherein the air discharge orifices are of lozenge shape.

6. A spraying device as claimed in either Claims 4 and 5, wherein the shorter diameters of the air discharge orifices are co-planar and so disposed as to intersect the longitudinal axis of the nozzle if projected.

7. A spraying device as claimed in Claim 4, wherein each elliptical air discharge orifice is wider at the ends of its longer diameter, whereby the tubular air jets are correspondingly thickened.

8. A spraying device as claimed in Claim 4, wherein each elliptical air discharge orifice is wider at the ends of its shorter diameter, whereby the tubular air jets are correspondingly thickened.

9. A spraying device as claimed in Claim 4, comprising in the bore of each elliptical air discharge orifice a plug having an elongated portion of substan-

tially elliptical cross-section, somewhat smaller than the elliptical bore, and spaced from the walls of the bore to provide a substantially elliptical annular passageway for the discharge of the tubular jet.

10. The method of setting the plug insert in a spraying device as claimed in Claim 9, which consists in fitting the base of the plug, to a rearward portion of the wing of the nozzle with the forward portion of the plug occupying the forward or outlet portion of the bore, inserting a tubular spacer implement of the same cross-sectional dimension as the orifice within the bore surrounding the plug, and then securing the base of the plug to the nozzle.

11. A setting tool for use in the method claimed in Claim 10 and as hereinbefore described, comprising a shank and a tubular end portion having an internal diameter and configuration substantially the same as the outside diameter and configuration of the plug, and an outer diameter and configuration substantially the same as the internal diameter and configuration of the bore.

12. A tool for correcting the centralisation of the plug within the bore in the method claimed in Claim 10, and as hereinbefore described, comprising a shank and a half-tubular end portion of substantially the same internal diameter and configuration as a half section of the plug, and of the same outer diameter and configuration as a half section of the bore.

Dated this 14th day of July, 1944.

BREWER & SON,
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33, Chancery Lane, London, W.C.2.

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[This Drawing is a reproduction of the Original on a reduced scale.]

FIG. 1.

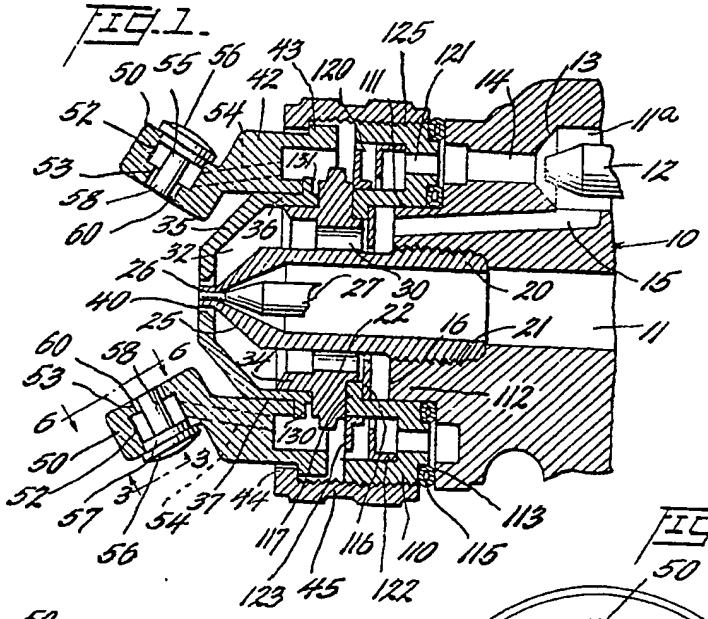


FIG. 2.

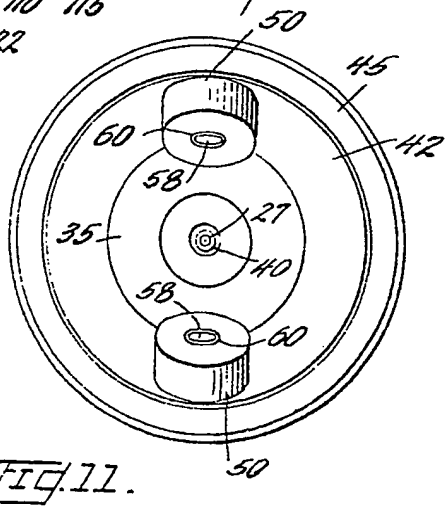


FIG. 3.

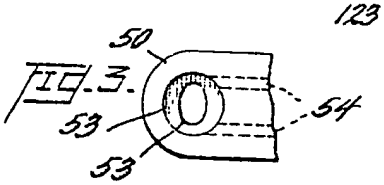


FIG. 4.

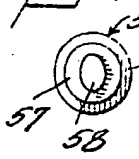


FIG. 5.

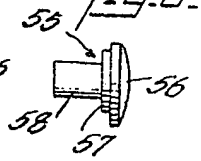


FIG. 6.

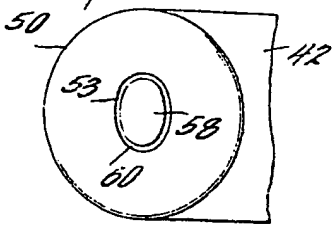


FIG. 11.

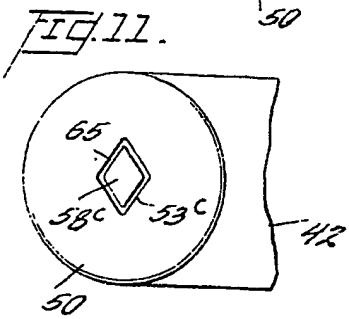


FIG. 7.

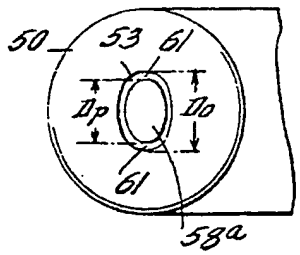


FIG. 8

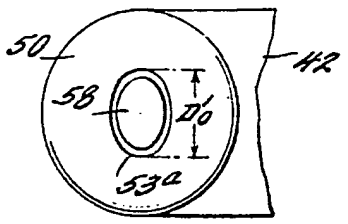


FIG. 9.

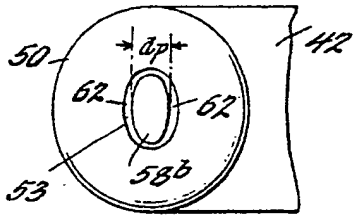


FIG. 10.

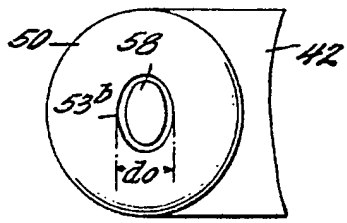


FIG. 2.

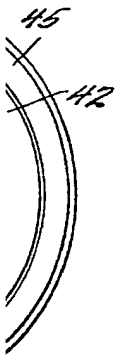


FIG. 13.

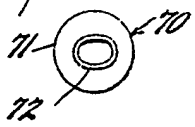


FIG. 12.

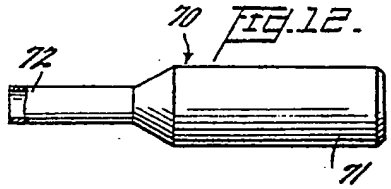


FIG. 15.

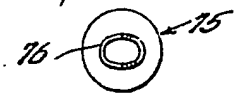


FIG. 14.

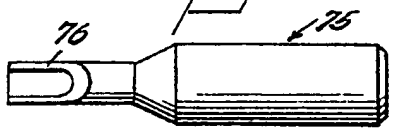
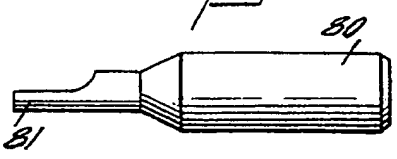


FIG. 17.

FIG. 16.



582,605 COMPLETE SPECIFICATION

2 SHEETS

SHEET 1

SHEET 2

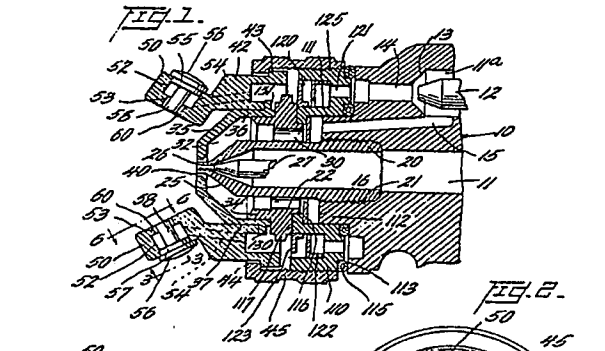


FIG. 1.

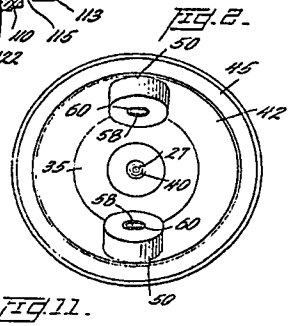


FIG. 2.

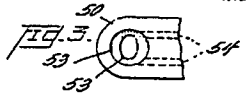


FIG. 3.

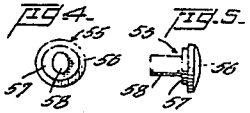


FIG. 4.

FIG. 5.

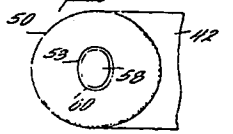


FIG. 6.

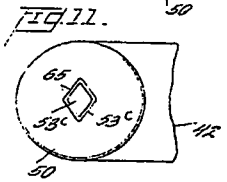


FIG. 11.

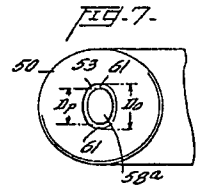


FIG. 7.

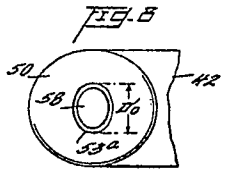


FIG. 8.

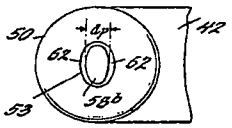


FIG. 9.

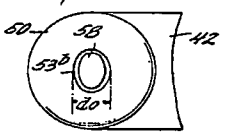


FIG. 10.

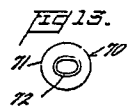


FIG. 13.

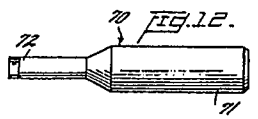


FIG. 12.

FIG. 15.

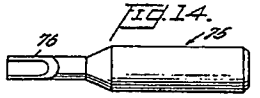


FIG. 14.

FIG. 17.

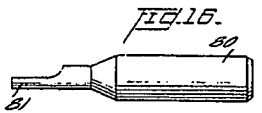


FIG. 16.

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